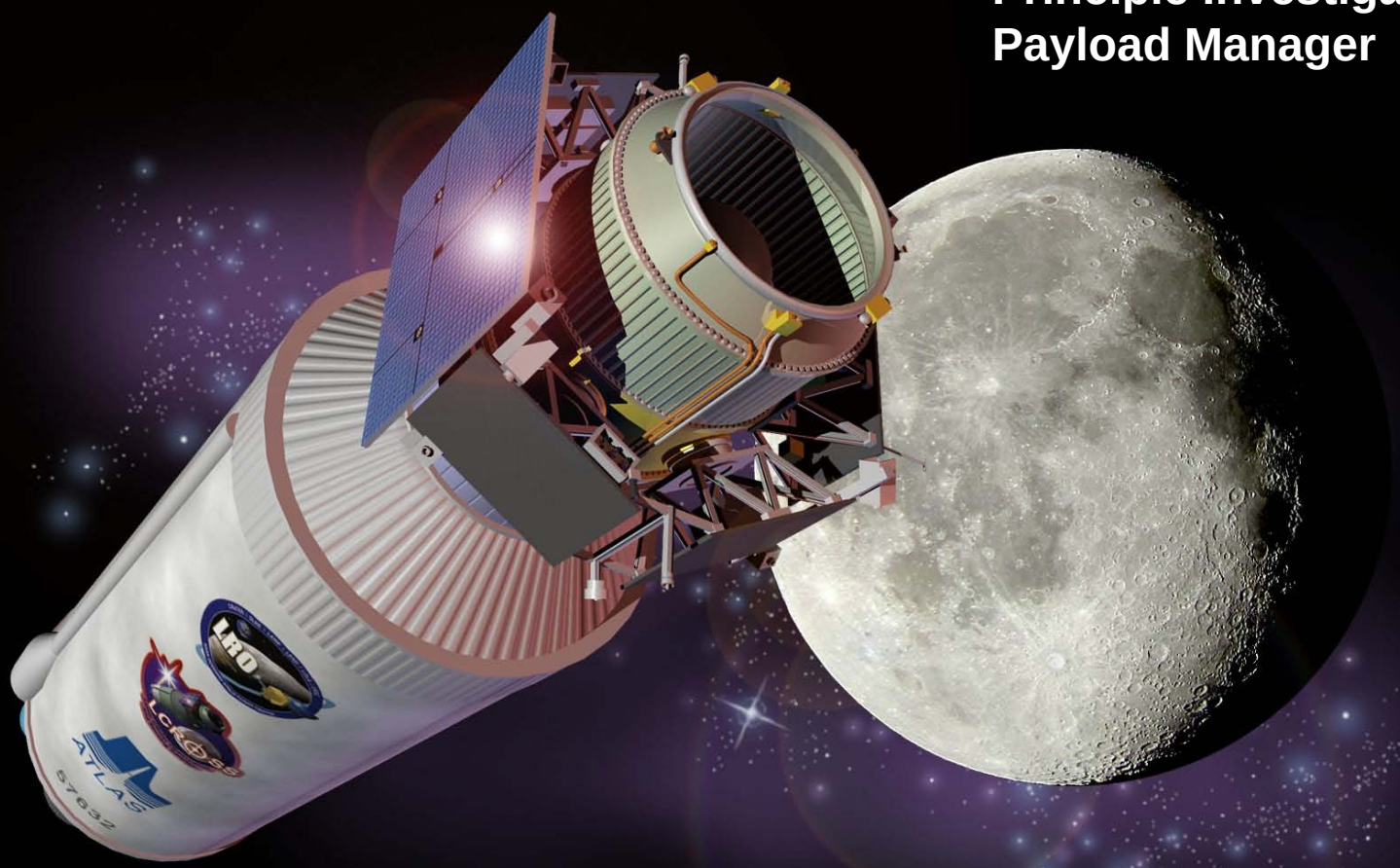
Lunar CRater Observation and Sensing Satellite Project

LCROSS Science Preview

Anthony Colaprete

Principle Investigator
Payload Manager



LCROSS Background

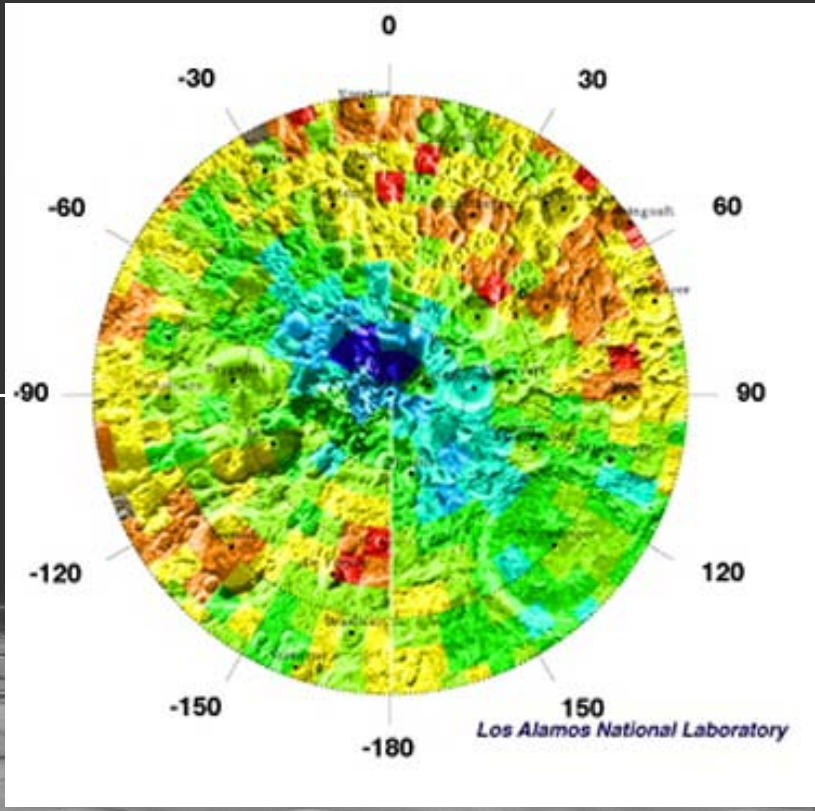
Lunar Prospector detected an increase in hydrogen concentration over the lunar poles.

The debate over the form, concentration and distribution has continued ever since.

If the hydrogen in an accessible and usable form, it could be a potential resource?

~~The form, distribution and concentration of~~ [H] relevant to inner solar system asteroid/comet fluxes, lunar volatiles and planetary evolution.

SP Hydrogen Abundance

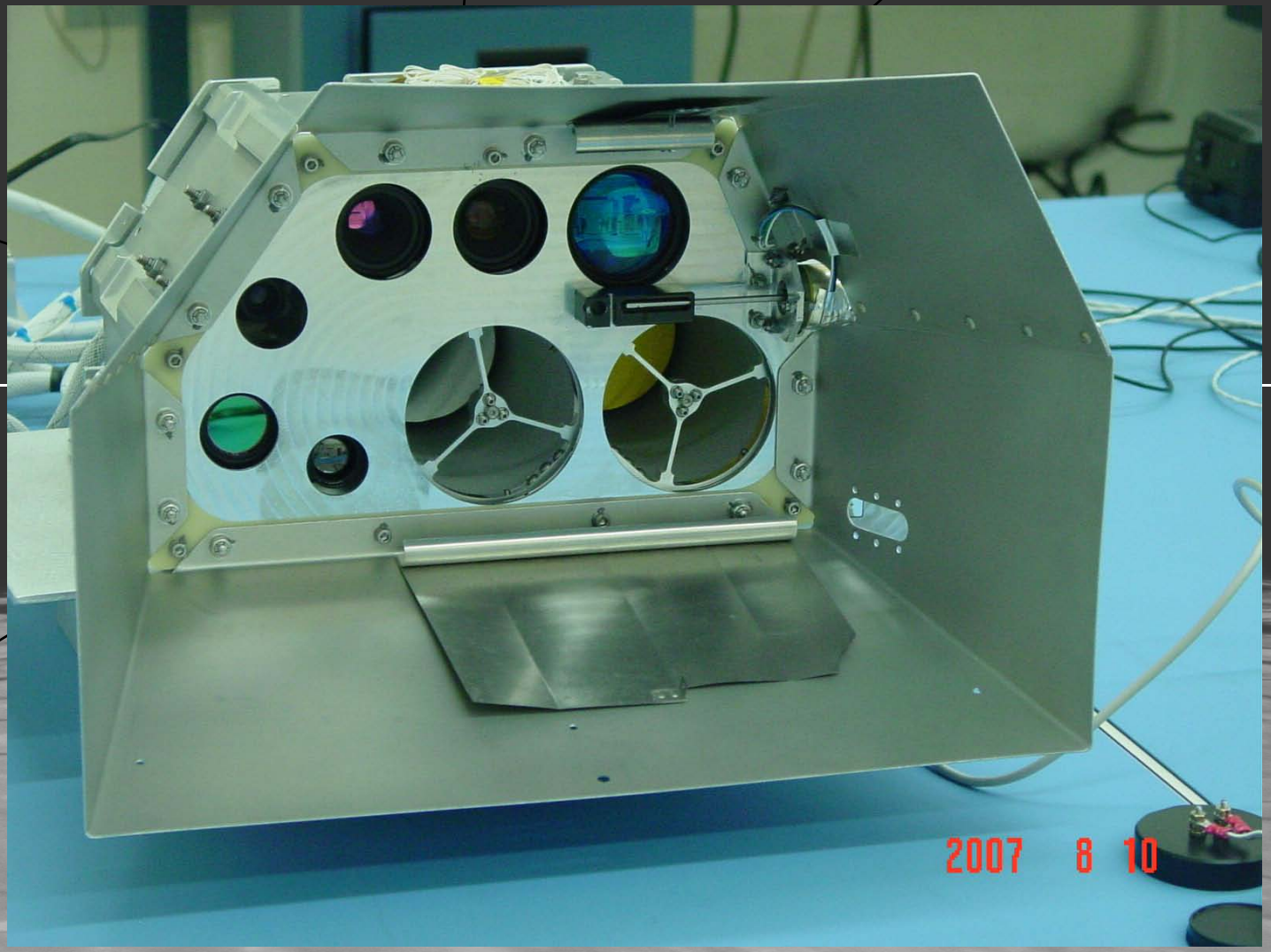


LCROSS will provide the most unambiguous data set to date as to the nature of lunar hydrogen

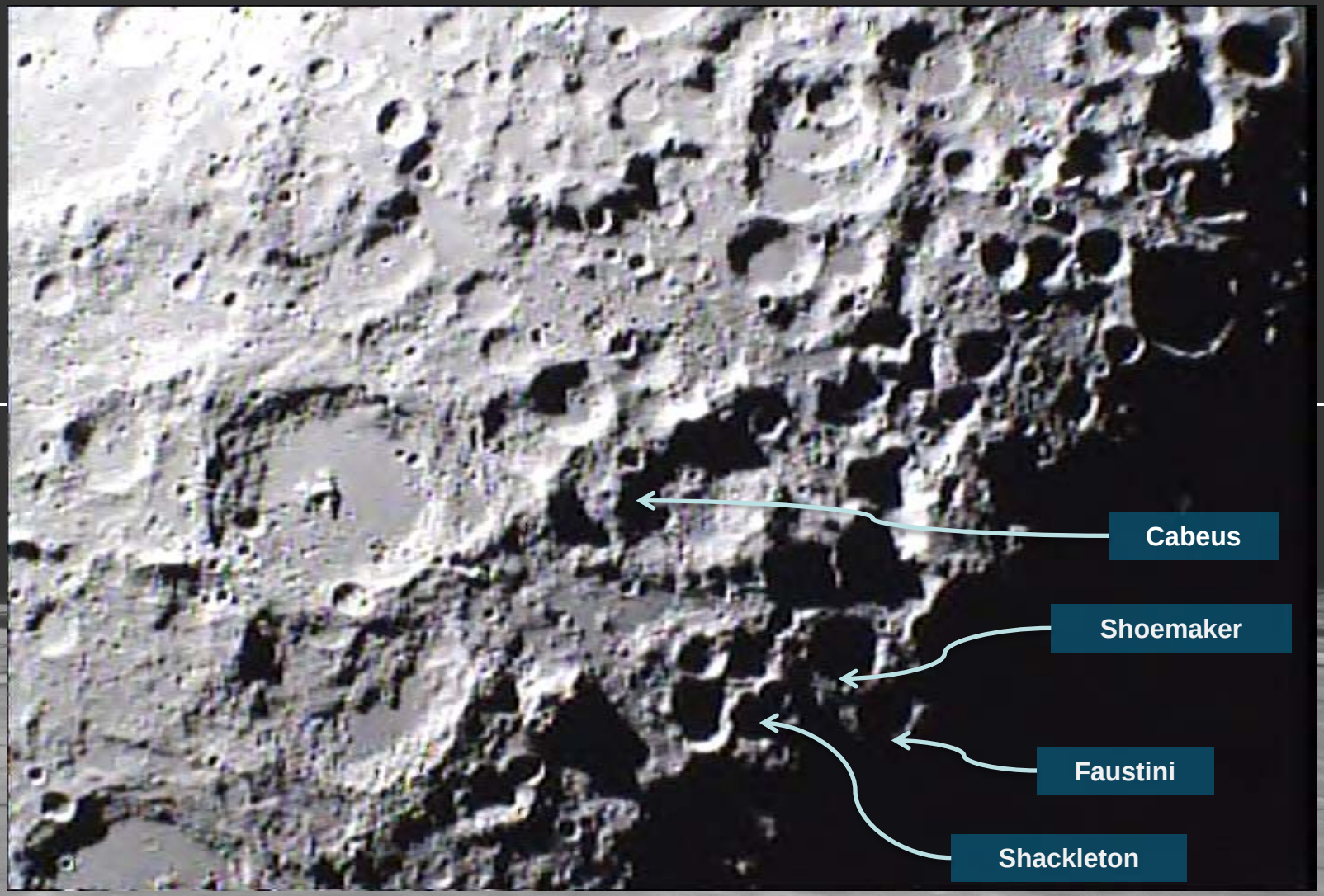
Question Addressed by LCROSS

- ✓ Nature and form of the hydrogen?
  - Water, hydrated minerals, hydrocarbons?
  - Grain size?
  - Distribution within regolith?
- ✓ Nature of PSR regolith?
  - ~~Strength? Depth?~~
  - Grain size?
  - Composition?
  - Is it similar to Apollo sites?
- ✓ The Lunar Atmosphere / Volatile Processes?
  - How does the Lunar atmosphere respond?
  - What are the times scales for recovery?
  - How do volatiles/dust migrate?

The LCROSS Payload



Visible Camera from 770 km

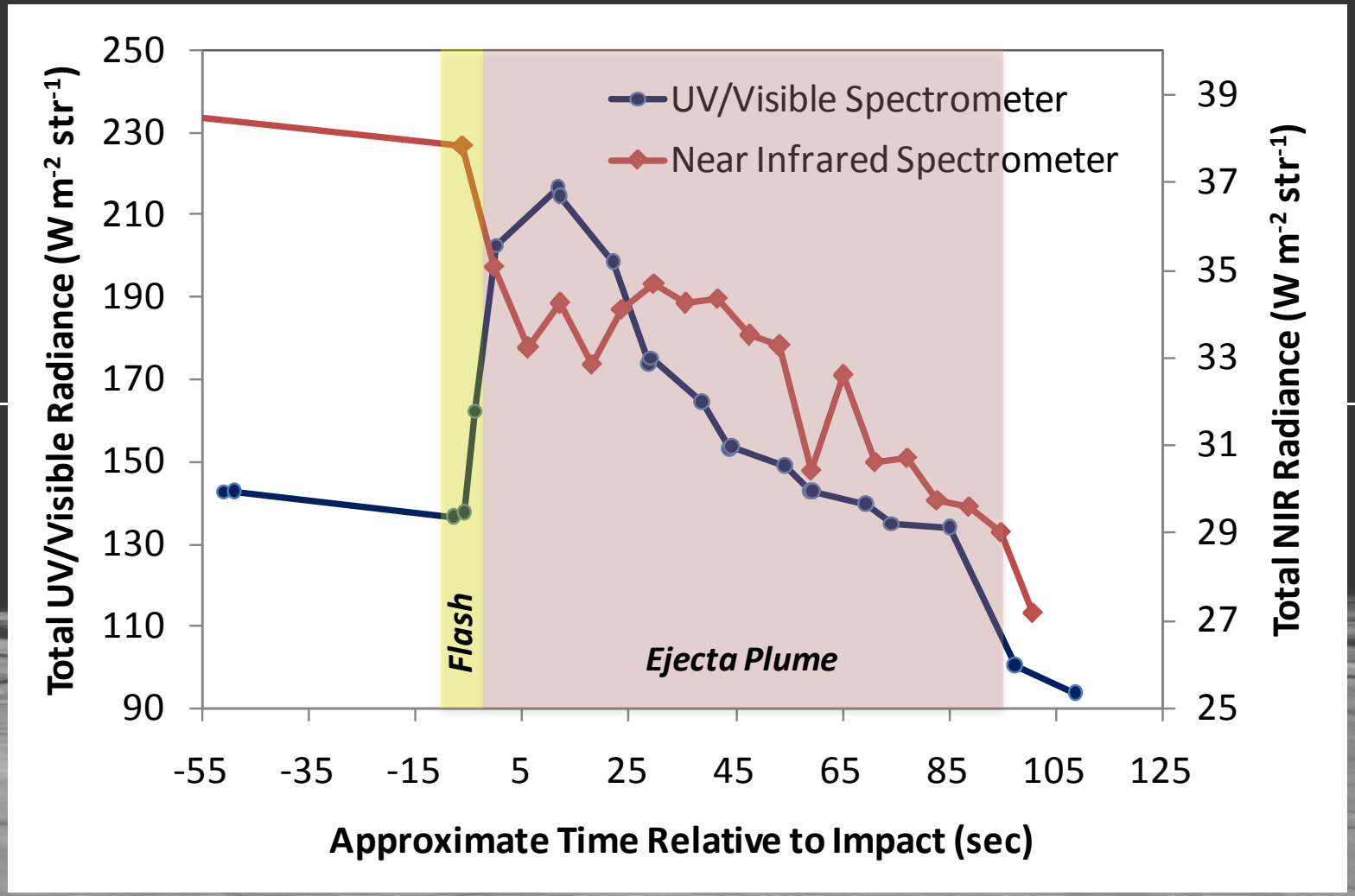


Visible Camera at impact (~600 km)

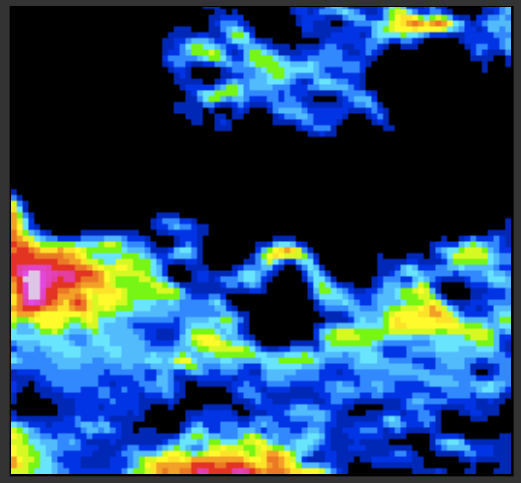
VisibleCamera Images from LCROSS Shepherding Spacecraft

Visible Camera at impact (~600 km)

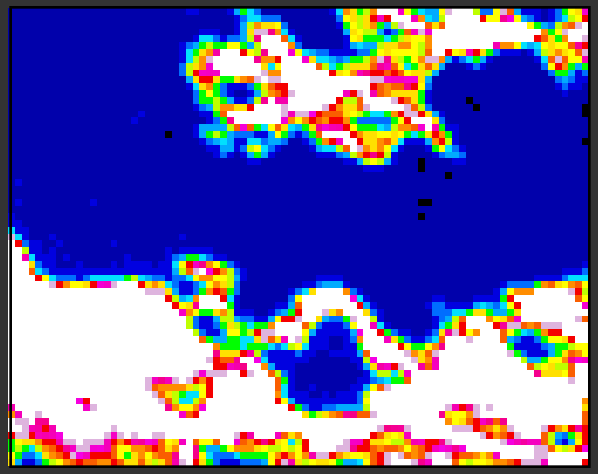
A Radiant Ejecta Plume



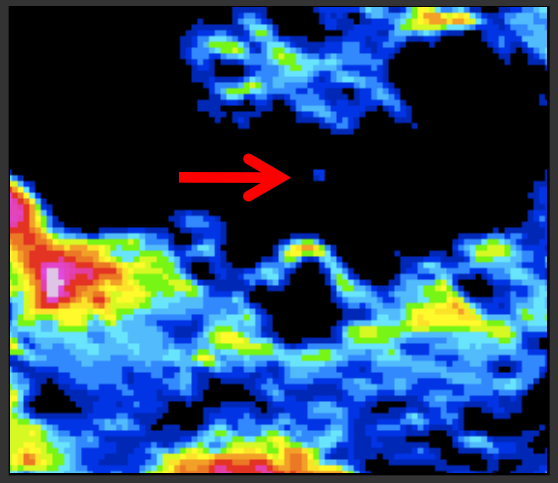
Impact Crater and Thermal Plume



T = -2 seconds
MIR2 camera



T = -2 seconds
MIR2 camera



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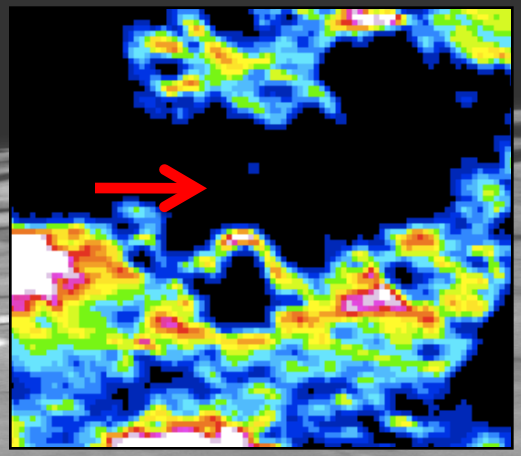
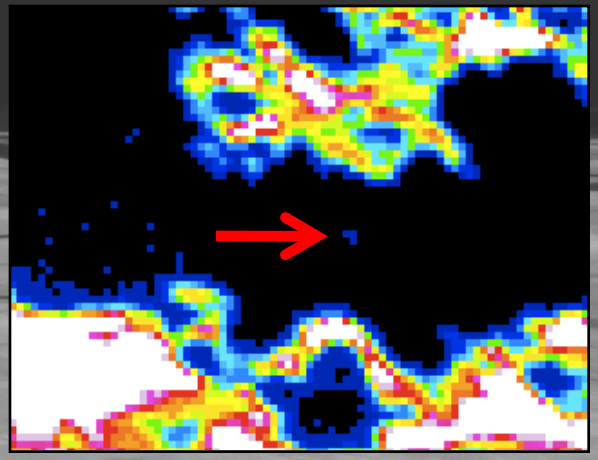
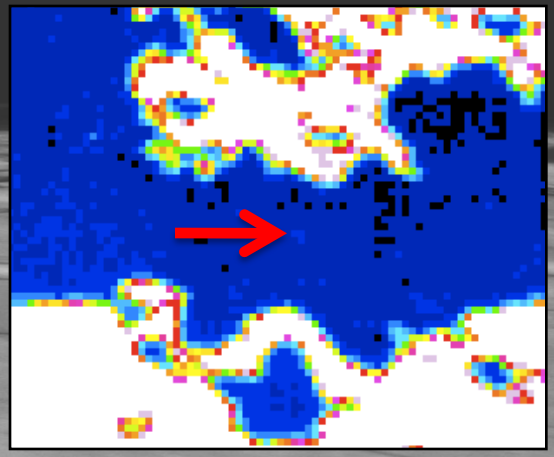
MIR2 camera



T = +2 seconds
MIR2 camera



T = +4 seconds
MIR2 camera

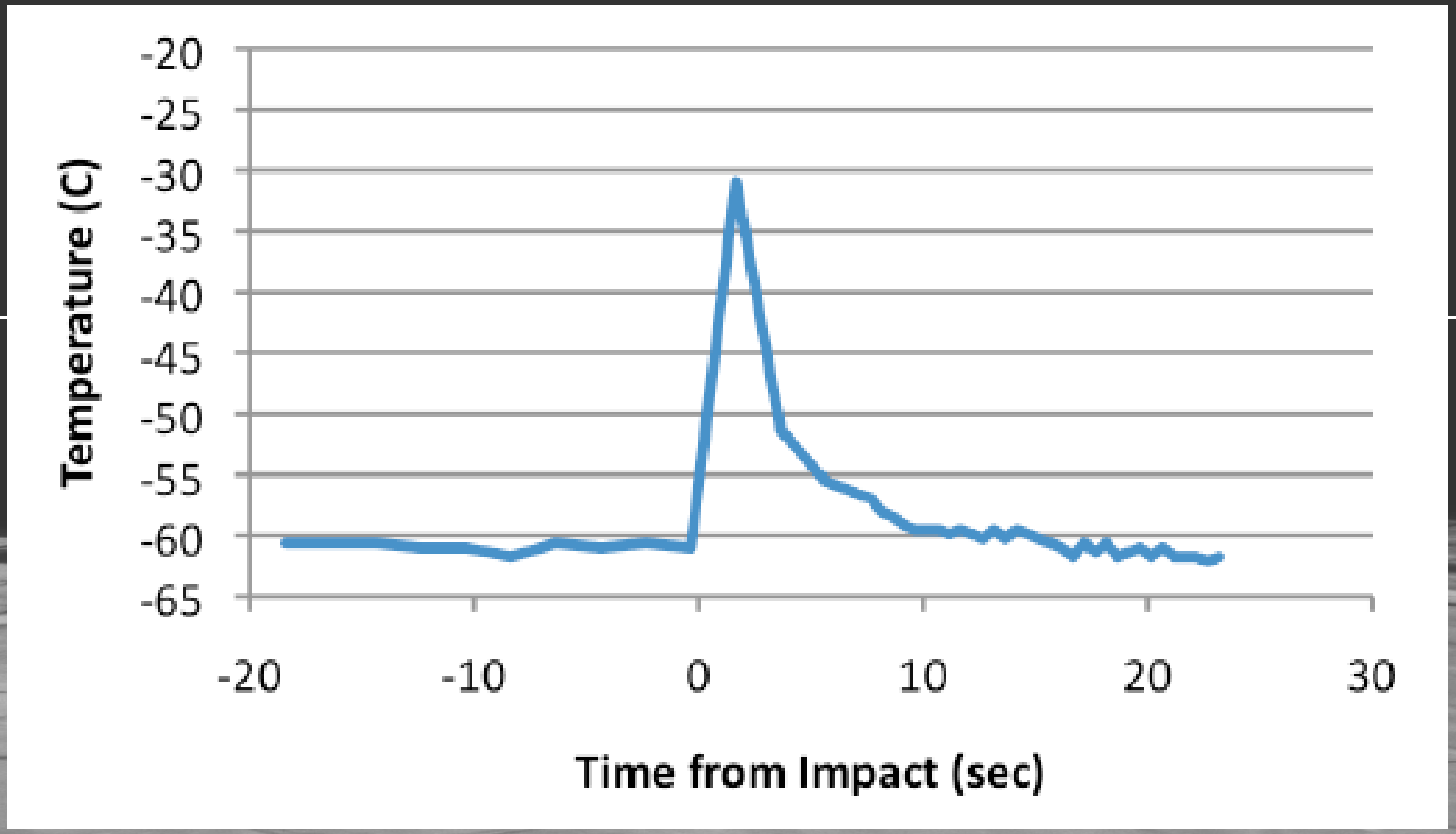


T = +6 seconds
MIR2 camera

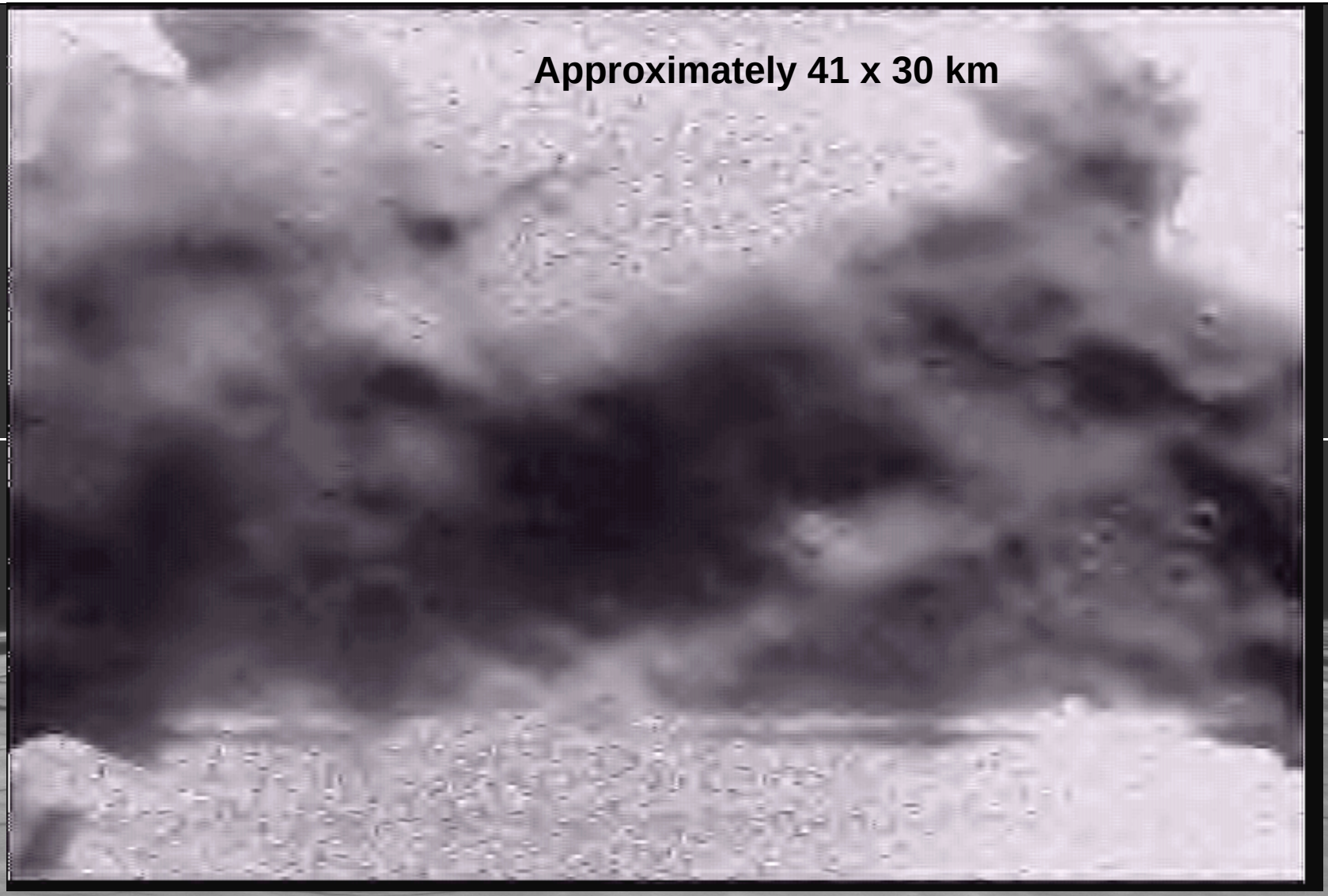
Impact Crater and Thermal Plume

Impact Thermal Plume Temperature for MIR1

Temperatures are underestimates as there is sub-pixel mixing



The Final Moments and a World Revealed



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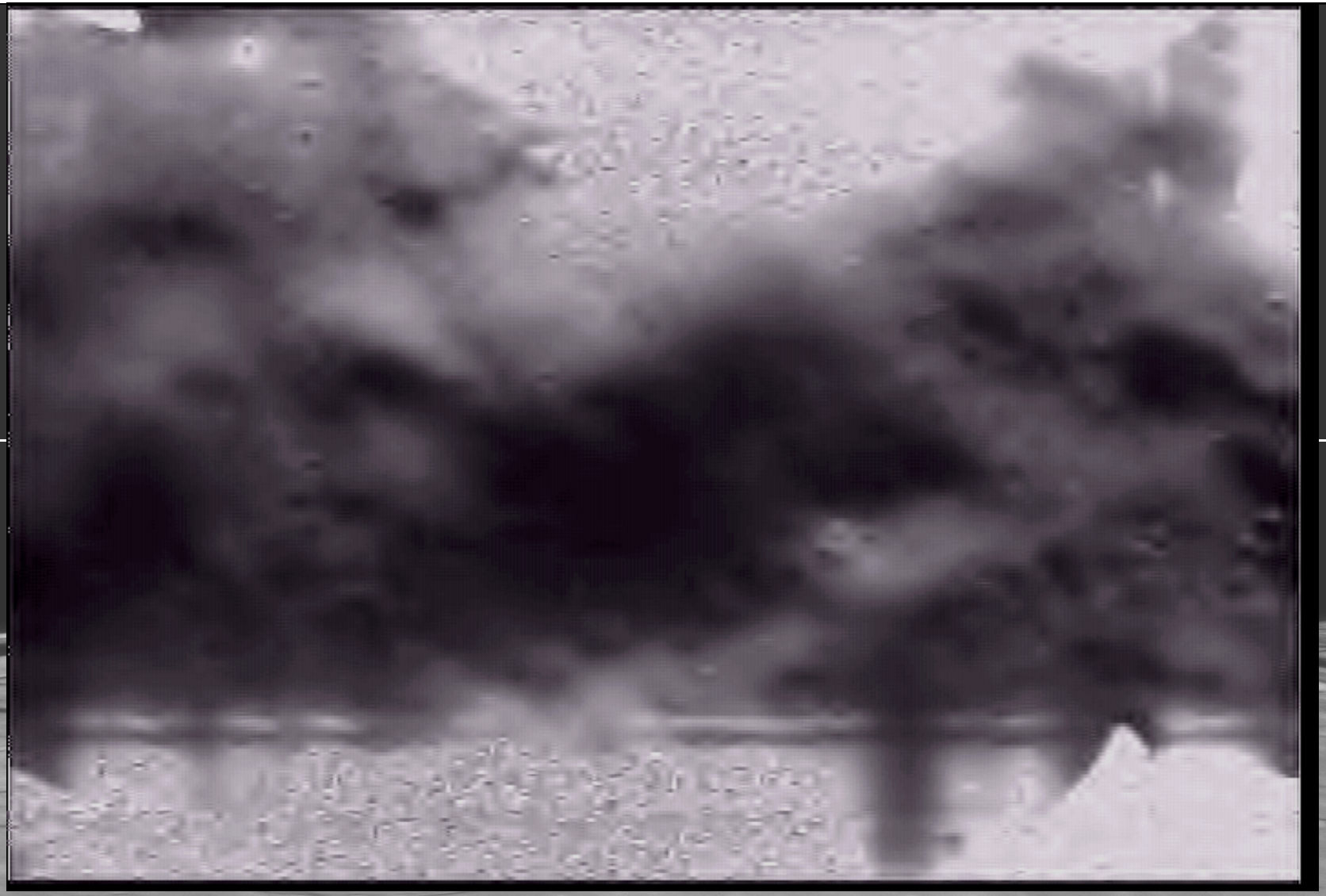
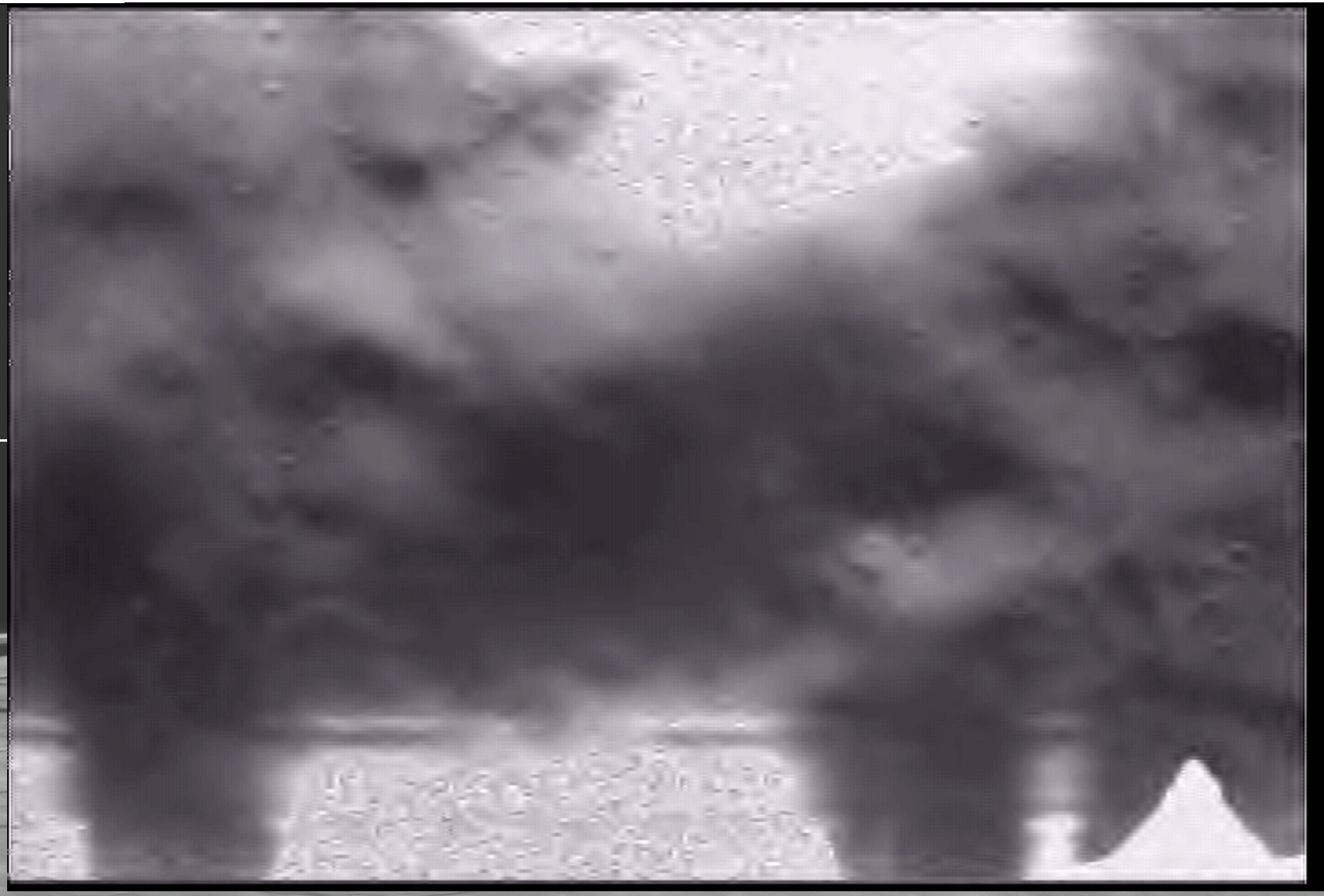
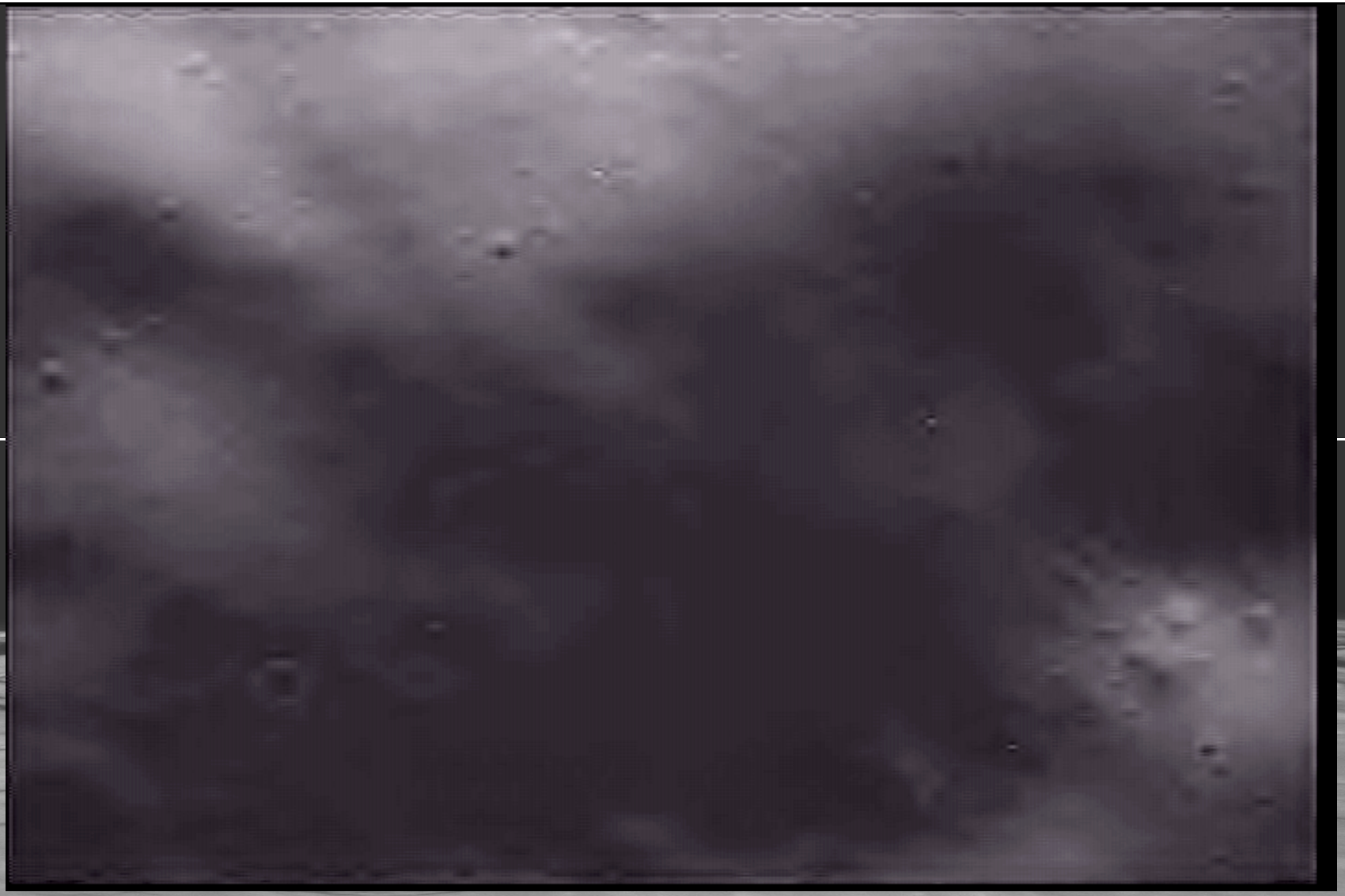


The Final Moments and a World Revealed



The Final Moments and a World Revealed



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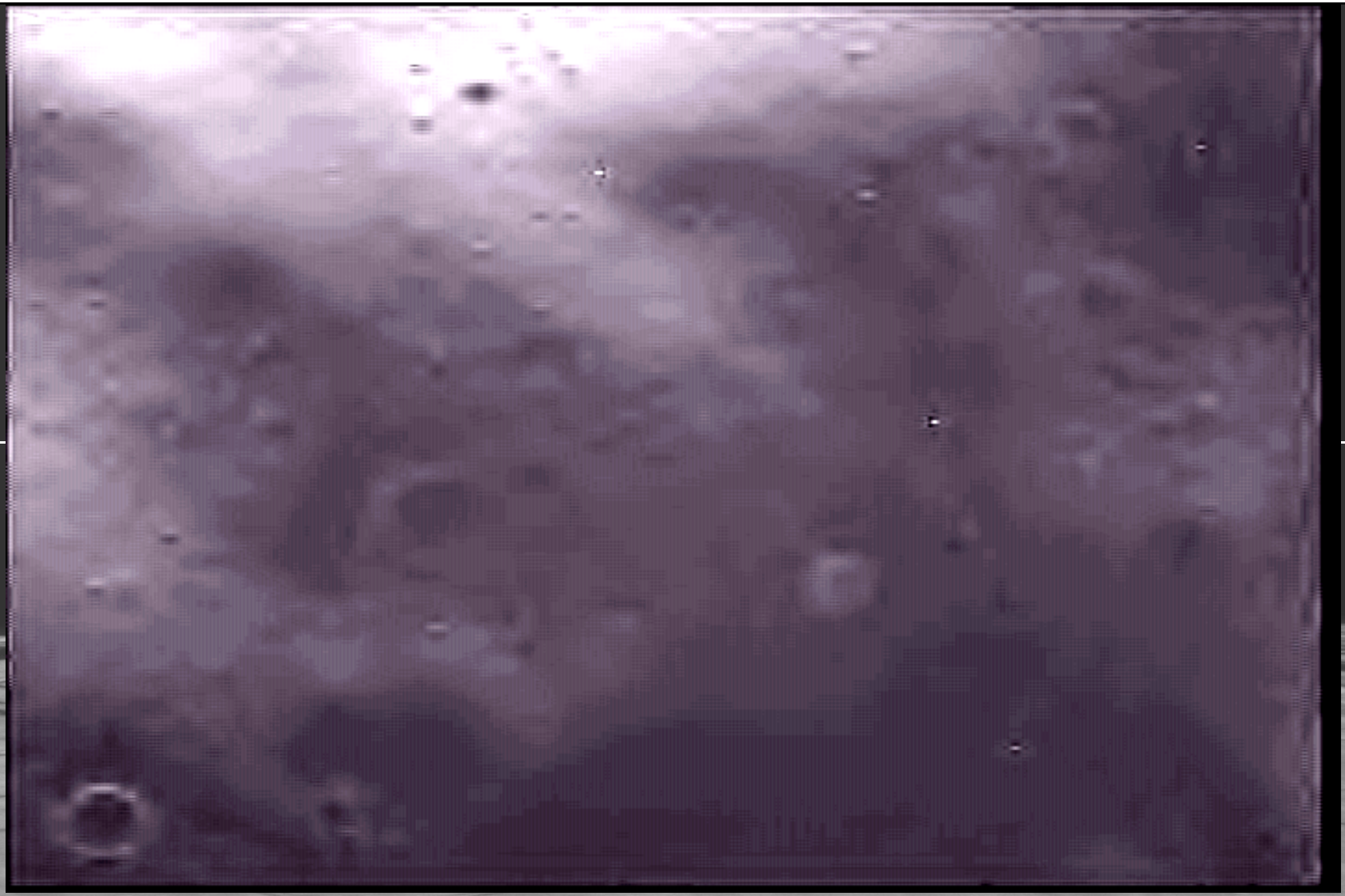

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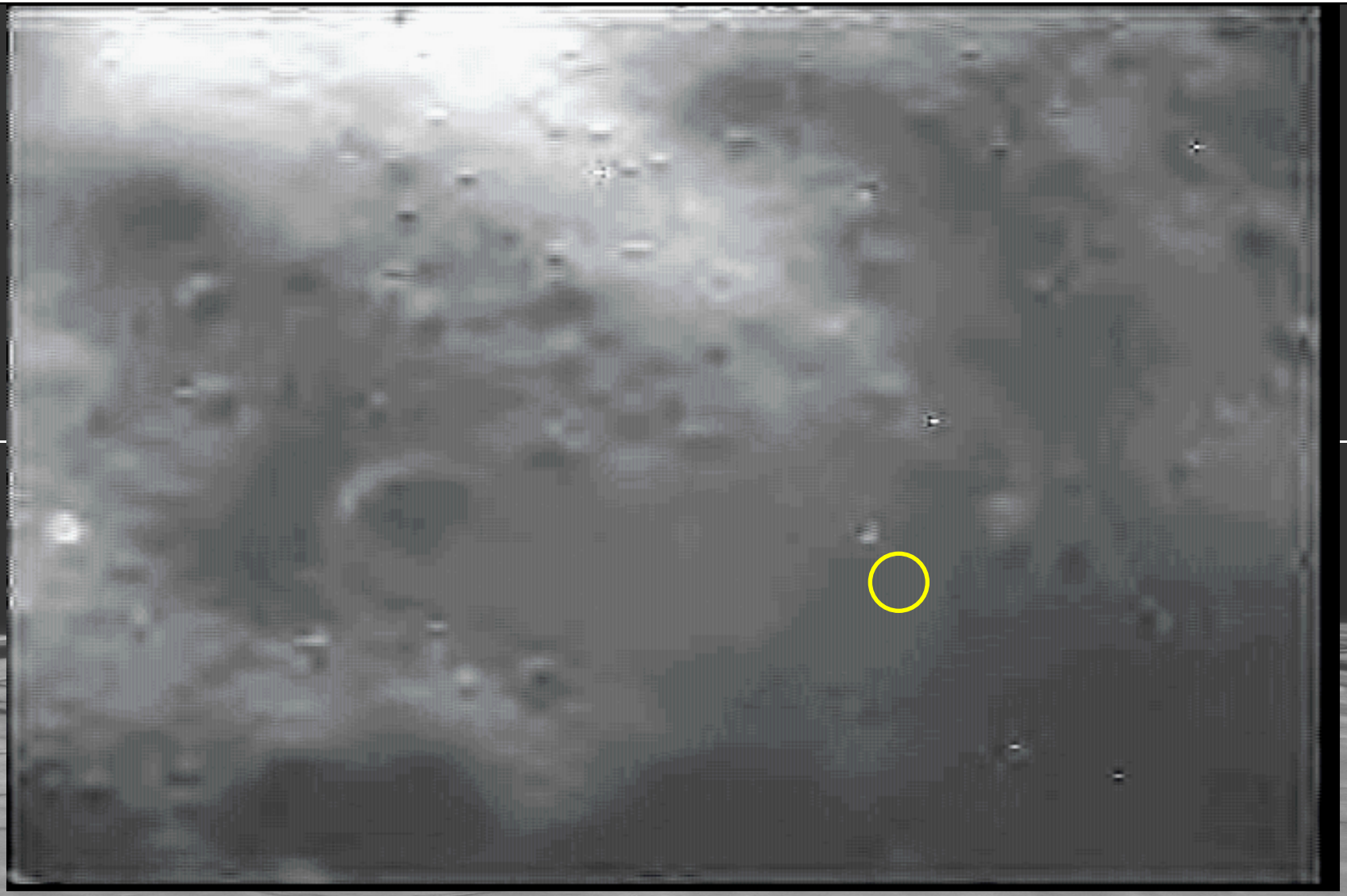
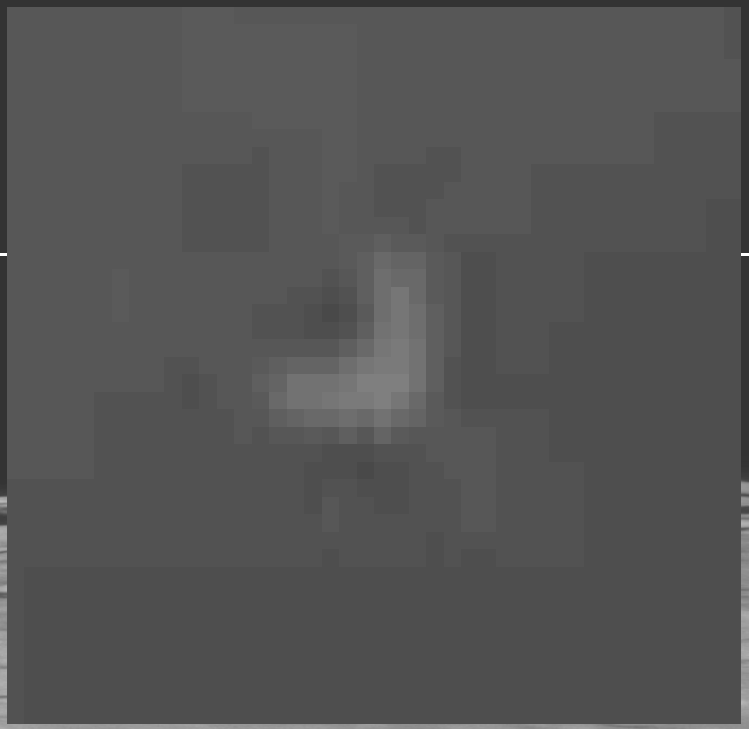


The Final Moments and a World Revealed

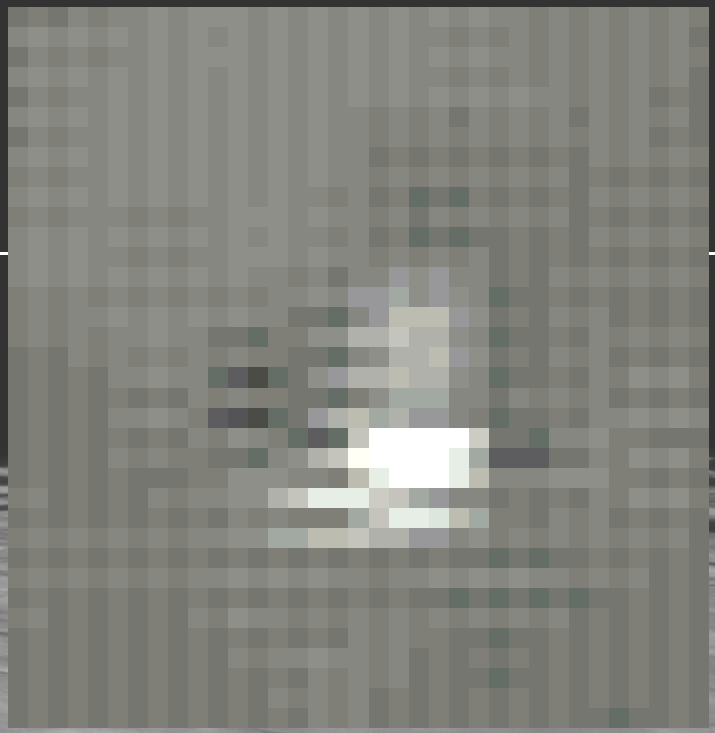
A fresh new Crater

NIR 2 Camera Images in last few seconds prior to SSC Impact

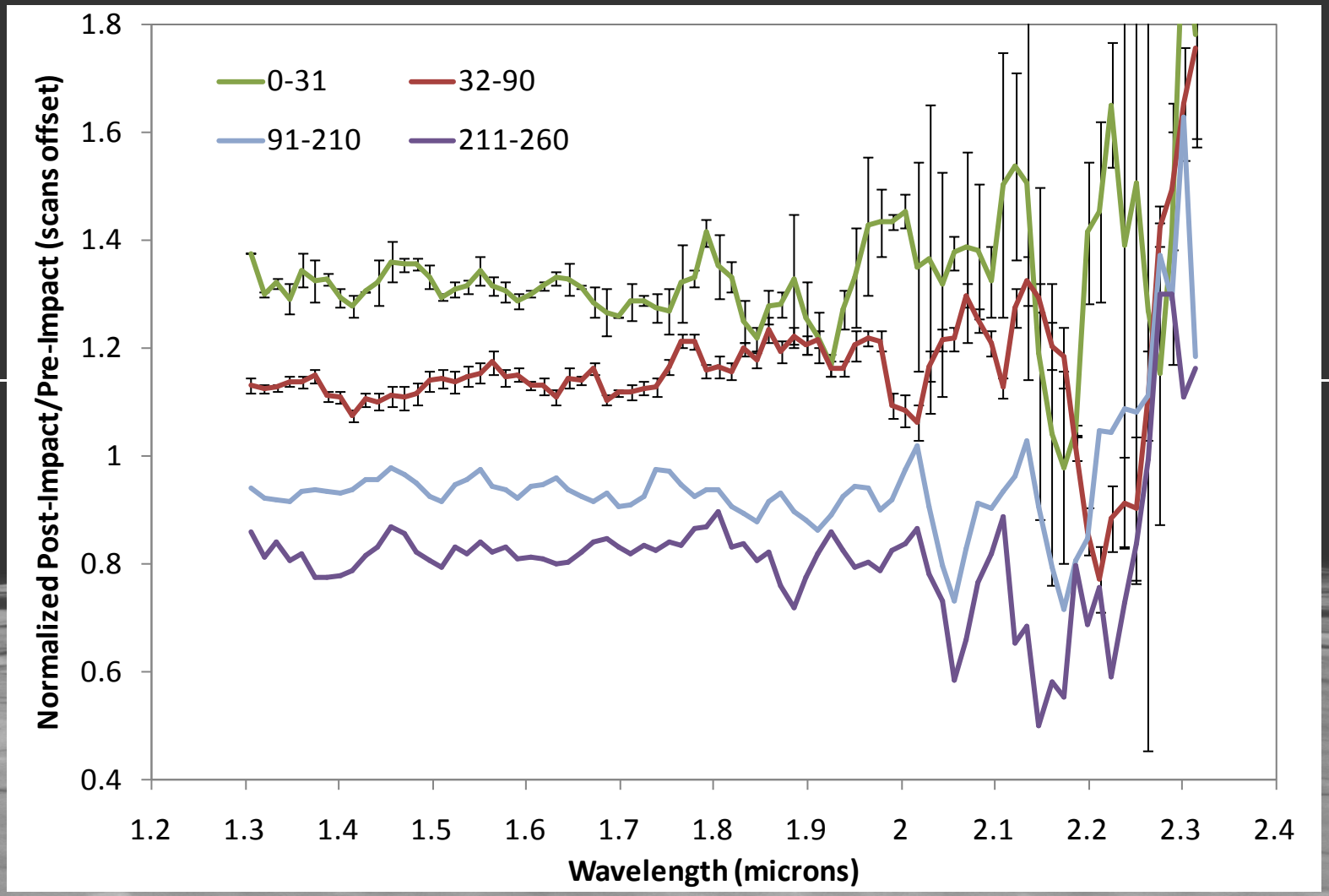
Resolution is ~5 meters/pixel



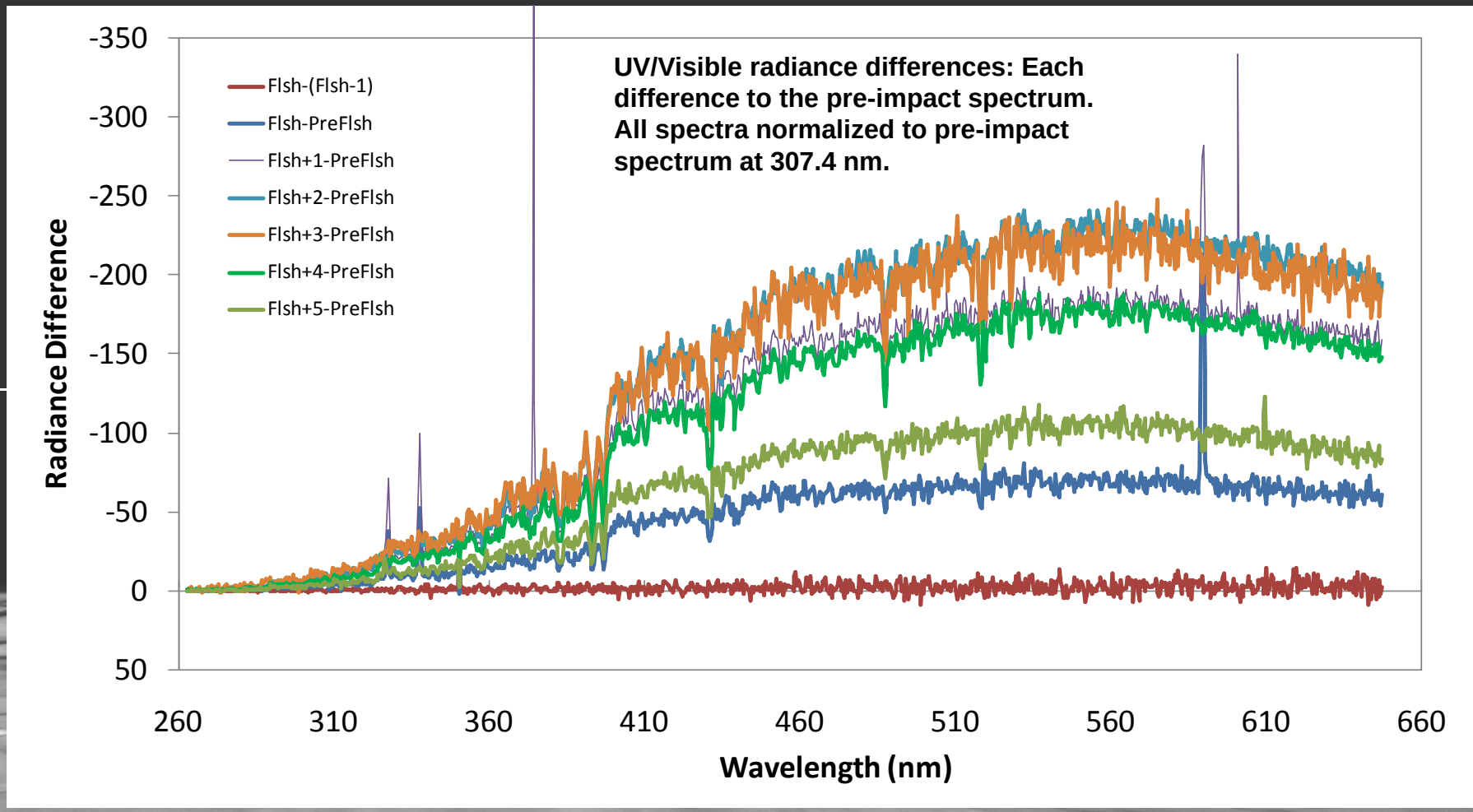
Resolution is ~3.2 meters/pixel



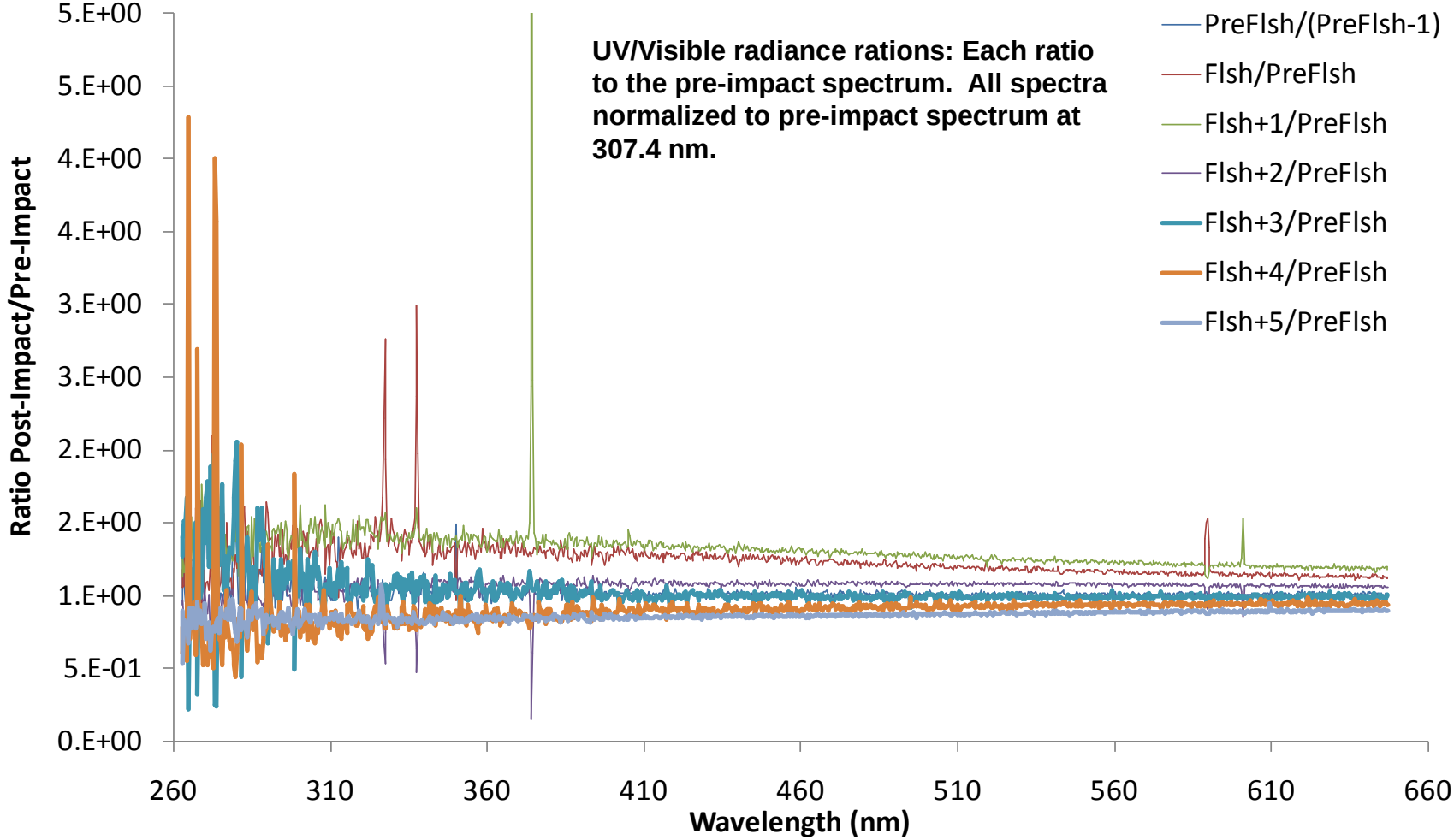
NIR Spectroscopy of Impact



UV/Visible Spectra of Impact



UV/Visible Spectra of Impact



Summary / Validation

The LCROSS mission science goals:

- Confirm the presence or absence of water ice in a permanently shadowed region on the Moon
- Identify the form/state of hydrogen observed by at the lunar poles
- Quantify, if present, the amount of water in the lunar regolith, with respect to hydrogen concentrations
- Characterize the lunar regolith within a permanently shadowed crater on the Moon

LCROSS data collected during impact, plume/curtain and crater exceeds expectations and addresses each mission goal:

- **The Team is working toward presentations at LEAG (November 17) and AGU (December 15)**
- **Working with the multiple complimentary observations from LRO and Earth observatories**

Linear Fit to Nadir NIR Spectra